

**OCEANEERING**<sup>®</sup>



Product to  
Patent Mapping

# M5 Connector

## Product Description

Our highly reliable M5 connection system provides an easy-to-install connection solution that enables injection of gas or chemicals into subsea infrastructure and serves as an access point for future intervention during the life of the field.

## Patent(s)

[US7380835B2](#)

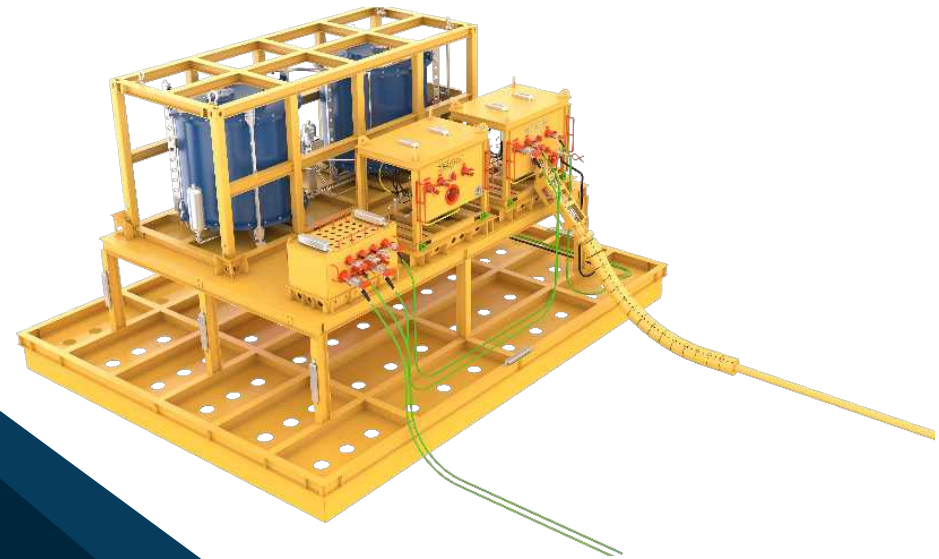
Single bore high flow  
junction plate



# Subsea Pumping Technology

## Product Description

The SPT system reduces or eliminates the storage, pumping, and delivery systems that typically occupy valuable topside real estate and the interface resources associated with topside chemical storage, bunkering, and handling. Multiple efficiencies can be realized by moving the equipment to the seabed and positioning them locally to the points of demand. Tanks of chemical product are replenished via tank exchange or filling from support vessel down lines



## Patent(s)

[US9915129B2](#)

Dual method subsea chemical delivery and pressure boosting

[EP3805464A1](#)

Dual method subsea chemical delivery and pressure boosting

[EP3500704A4](#)

Dual method subsea chemical delivery and pressure boosting

[EP3783191A1](#)

Dual method subsea chemical delivery and pressure boosting

[AU2017326152A1](#)

Subsea fluid storage system

[US10370186B2](#)

Subsea fluid storage system, method

[EP3512783B1](#)

Subsea fluid storage system

[CA3033005A1](#)

Subsea Charge Pump

[US2019264674A1](#)

Subsea fluid storage system

[US9656800B2](#)

Subsea fluid storage system

[EP3172151A4](#)

Subsea pressure compensating pump apparatus

[US9574557B2](#)

Subsea pressure compensating pump apparatus

[EP3172442B1](#)

Subsea pressure compensating pump apparatus

# Subsea Distribution Unit

## Product Description

Deployed to the seafloor, distribution units are configured to include the hydraulic and electrical interfaces that support your system. From the routine to complex, our engineers deliver the most effective, robust solutions to ensure production and uptime.



## Patent(s)

### [US10024137B2](#)

Compact distributed subsea distribution of hydraulic power and chemical injection

### [EP3436657B1](#)

Compact distributed subsea distribution of hydraulic power and chemical injection

# Umbilical Termination Head

## Product Description

Umbilical termination heads (UTHs) are a simple solution for connecting subsea umbilicals to subsea architecture

and eliminate the need for umbilical termination assemblies (UTAs) or hydraulic flying leads (HFLs).



## Patent(s)

[US10801289B2](#)

Versatile flying lead  
(HFL) termhead  
system

[EP3755870A4](#)

Versatile flying lead  
(VFL) termination head  
system

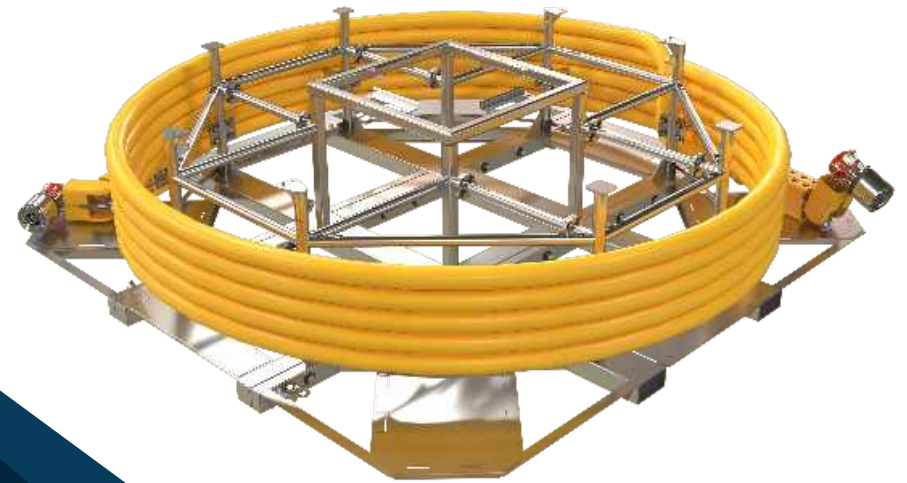
[US11401766B2](#)

Versatile flying lead  
(VFL) termhead  
system

# Hydraulic Flying Leads

## Product Description

Connect your subsea infrastructure—from umbilical termination assemblies (UTAs) and manifolds to X-mas trees and subsea distribution units—using our field-proven flying leads. Our flying leads support the safe and efficient conveyance of hydraulic fluid and chemicals.



## Patent(s)

[US8607826B2](#)

Interlocking bend  
limiter and method of  
assembly

# Umbilicals

## Product Description

subsea umbilicals provide the critical connections between subsea architecture and distribute power, control, and communication functions in the deepest and harshest of environments.



## Patent(s)

[US7493918B2](#)

Fluid conduit

[US6901968B2](#)

Fluid conduit

[GB2385399B](#)

Fluid conduit

[US9360138B2](#)

Umbilical hose with improved cyclic ovalisation resistance

[GB2505606B](#)

Umbilical hose with improved cyclic ovalisation resistance

[GB2505605B](#)

Improved umbilical with fatigue resistant fibres

[US7239781B2](#)

Composite fiber radial compression members in an umbilical

[SG132209B](#)

[MX294444B](#)

[SG201307742A1](#)

[US9208926B2](#)

Active cooling of medium voltage power umbilicals

[US9190825B2](#)

Molded testable long term subsea abandonment cap for electrical cables and method of manufacture

# Subsea Pig Launcher

## Product Description

Our subsea pig launchers eliminate the requirement for a service flowline and reduce field development costs. Subsea and surface-loadable, our ROV- and remotely-operated configurations accommodate your requirements for pig capacities and types. Our solution for remotely operated subsea pig launching was awarded a Hart's E&P Special Meritorious Award for Engineering Innovation.

## Patent(s)

[CY1107170T1](#)

SUBSEA PIG  
LAUNCHING AND  
RECEIVING SYSTEM  
AND METHOD OF USE  
AND INSTALLATION



# Junction Plate

## Product Description

Oceaneering® M Series Junction Plates consist of fixed and removable assemblies configured to meet project requirements. They allow remotely connecting subsea structures to support chemical injection by preventing well blockage, supplying hydraulic power to open and close subsea mounted valves, and facilitating the completion of well annulus pressure monitoring.

## Patent(s)

[US7243729B2](#)

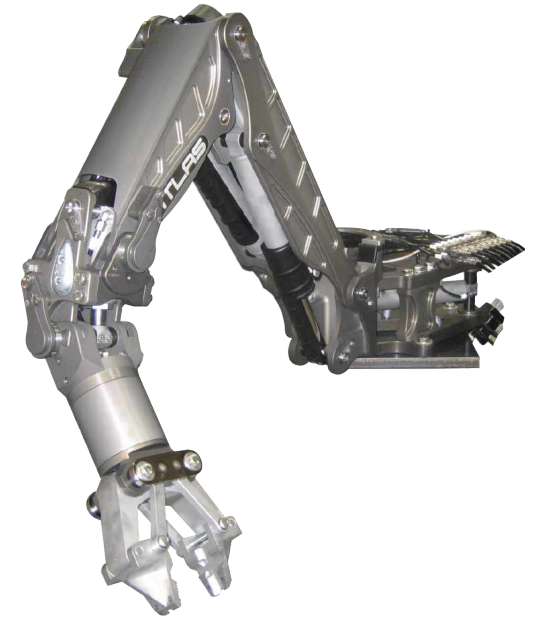
Subsea junction plate assembly running tool and method of installation



# Atlas Hybrid Manipulator

## Product Description

Oceaneering exclusively offers the Atlas Hybrid manipulator arm for use on Remotely Operated Vehicles (ROVs). The manipulator was designed in conjunction with Schilling Robotics and has benefited from Oceaneering's extensive experience of operating ROV-mounted manipulators, with ruggedness, ease of maintenance and optimized up-time being the primary design goals.



## Patent(s)

[US7466099B2](#)

Multi-mode manipulator arm and drive system

[AP2951A](#)

A multi-mode manipulator arm and drive system

[CA2646390C](#)

A multi-mode manipulator arm and drive system

[EA012196B1](#)

A multi-mode manipulator arm and drive system

[SG145267B](#)

[MX289128B](#)

[OA14263A](#)

IP Intelligence | Patent Intelligence Software

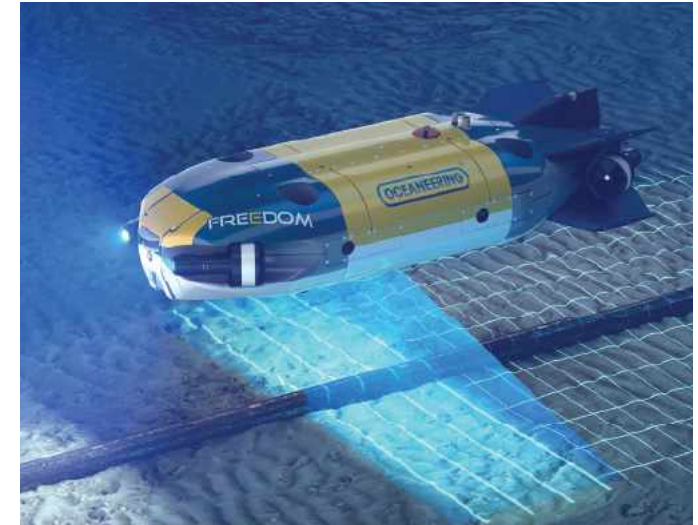
[OA14262A](#)

IP Intelligence | Patent Intelligence Software

# Freedom Autonomous Vehicle/Next Gen ROV

## Product Description

Freedom™ Autonomous Vehicle: The Freedom Autonomous Vehicle provides a new level of flexibility and efficiency by combining the features of a ROV and an AUV into one system. Typical tasks include pipeline survey, seabed survey, close visual inspection and light intervention activities.



## Patent(s)

[US8900106B2](#)

Subsea tool changer

[US10286566B2](#)

Manipulator end effector

[US11292563B2](#)

Methods for subsea vehicles supervised control

[WO2019113498A1](#)

Methods for subsea vehicles supervised control

[EP3720766A4](#)

Methods for subsea vehicles supervised control

[US11530018B2](#)

Subsea inspection vehicle

[EP3758897A1](#)

Methods for subsea vehicles supervised control

[WO2019169173A1](#)

Methods for subsea vehicles supervised control

[US9294151B2](#)

Subsea inspection vehicle

[EP2944030B1](#)

Wireless data transmission via inductive coupling using DI/DT as the magnetic modulation scheme and hysteresis

[EP2987174A4](#)

Wireless power transmission via inductive-coupling using magnets

[EP2987246B1](#)

Wireless data transmission via inductive coupling using DI/DT as the magnetic modulation scheme and hysteresis

[US9762089B2](#)

Wireless power transmission via inductive coupling using di/dt as the magnetic modulation scheme

[US9124306B2](#)

Wireless data transmission via inductive coupling using di/dt as the magnetic modulation scheme without hysteresis

[US10128909B2](#)

Subsea contactless connector system and method with extremely high data transfer rate

[EP3387218A4](#)

Extremely high speed data transfer and communications

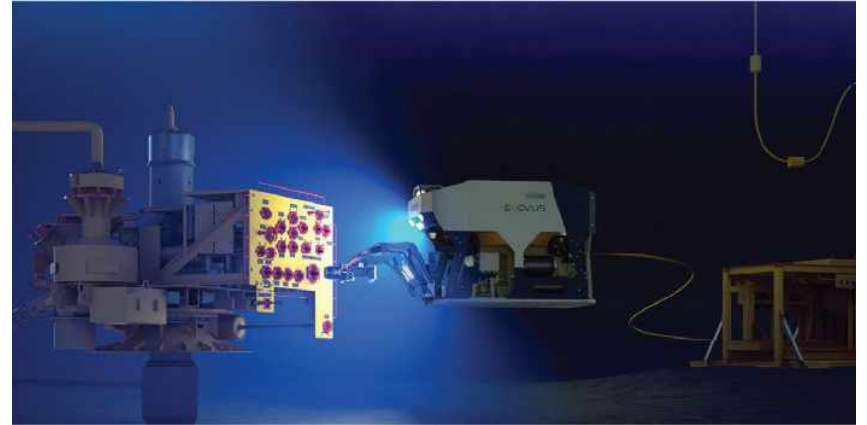
[EP3391395A4](#)

Slip ring with data rate sensors

# Resident ROV E-ROV system

## Product Description

Our self-contained, battery-powered Liberty E-ROV system increases operational efficiency and combines the best of Oceaneering technologies to deliver an industry-leading, resident ROV solution. The remotely operated system enables operators to intervene faster, keep production online more effectively, and perform routine tasks with fewer deployments.



## Patent(s)

[US9505473B2](#)

Remotely operated vehicle integrated system

[US2017026085A1](#)

Resident ROV Signal Distribution Hub

[EP3325760A4](#)

Resident ROV Signal Distribution Hub

[US10523047B2](#)

Autonomous ROVs with offshore power source that can return to recharge

[EP3429918A4](#)

Rechargeable autonomous ROVs with an offshore power source

[EP3429914A4](#)

Buoy-based electric power system

[US8686681B2](#)

Power supply apparatus for electronic, electrical, and electromechanical installations

[BRPI0712102B1](#)

Power supply apparatus for electronic, electrical or electromechanical equipment

[CA2657987C](#)

An apparatus for operating controlling installation means

[RU2441307C2](#)

Device to operate controlled installation facility

[ZA200810866B](#)

An apparatus for operating controllable installation means

[NO339924B1](#)

A system and method of operating an unmanned underwater vehicle

[GB2563549B](#)

A system and method of operating a subsea module

[NO342840B1](#)

A system and method of operating a subsea module

[US10766577B2](#)

System and method of operating a subsea module

[US10858076B2](#)

ROV deployed buoy system

[EP3781471A4](#)

ROV deployed power buoy system

[WO2019236797A1](#)

ROV deployed power buoy system

# Remote Piloting

## Product Description

Remote Piloting and Automated Control Technology: Our innovative remote piloting and automated control technology (RPACT) enables full ROV piloting via virtual connection technologies such as vessel-to-vessel radio frequency (RF), satellite/Internet, or subsea optical link.



## Patent(s)

[US9869998B2](#)

Wireless data communications between a remotely operated vehicle and a remote location

[EP3092867A4](#)

Wireless data communications between a remotely operated vehicle and a remote location

# Tooling Interface-ATI

## Product Description

Our innovative, next-generation ROV interface provides reliable, efficient tool change out during subsea intervention operations. Benefiting from a universal, dual-motor drive inclusive of torque feedback, the Omni interface significantly increases subsea operational efficiency with its multi-function tooling package. The interface design features pinless power and communications and includes integrated radio-frequency identification (RFID) capabilities. The RFID functionality can be used to correctly identify tools and subsea assets while providing insight on required tool maintenance.

## Patent(s)

[US2019224858A1](#)

Adaptive Tooling  
Interface

[EP3743248A4](#)

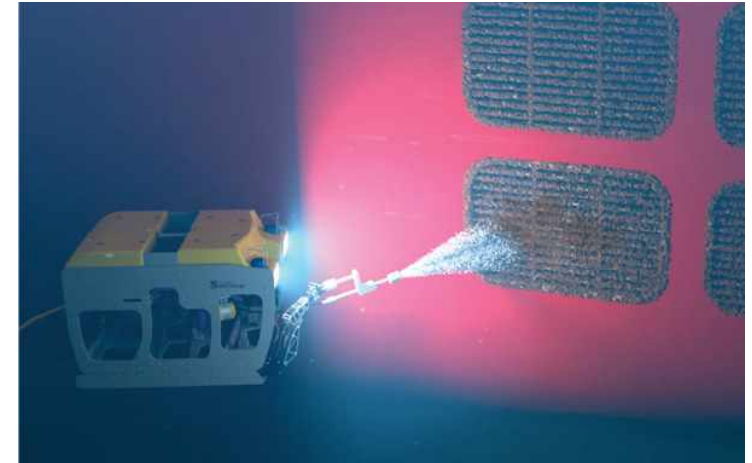
Adaptive Tooling  
Interface



# Hull Cleaning

## Product Description

Efficient Hull Cleaning: Effectively spot clean hulls, thrusters, sea chests, and hull markings with ROV- or deck-mounted cavitation blasters. Avoid damage to critical assets with air blasting and cleaning water pumped at 3,000 psi.



## Patent(s)

[US10414473B2](#)

Subsea structure cleaning apparatus and method

[US2020023925A1](#)

Vessel hull cleaning apparatus and method

# Hot Stab

## Product Description

Our API 17D, API 17H, and high-flow hot stabs and receptacles are manufactured and tested to the highest industry standards. All products are supplied with test certificates, Certificate of Conformity (COC), and are individually packaged to protect critical sealing surfaces.

## Patent(s)

[N0324407B1](#)

A hotstab device for  
use under water



# Internal Multi String Cutting Tool

## Product Description

Our IMCT uses AWJC technology to sever conductor casings internally at least 15 ft (5 m) below the mudline, without the need for external dredging.

The IMCT accommodates standard API casing sizes from 7 in to 20 in, and can be deployed from a platform, drilling support vessel, drilling rig, or heavy lift vessel.

## Patent(s)

[US7178598B2](#)

Device for a hydraulic cutting tool

[DE60310397D1](#)

Device for a hydraulic cutting tool

[DK1509673T3](#)

Device for a hydraulic cutting tool

[EP1509673B1](#)

Device for a hydraulic cutting tool



# Hydrate Remediation Skid

## Product Description

The Hydrate Remediation Skid (HRS) is ROV deployed and operated skid that depressurizes small volume production piping such as jumpers, wellheads, umbilicals, and chemical injection lines. Instruments show the upstream, downstream, and inhibitor inlet pressures in real time. Pressurized hydrate inhibitors are routed through the production piping in either direction to inhibit the flowline and prevent hydrate reformation.



## Patent(s)

### [US9238955B2](#)

System and method for subsea structure obstruction remediation using an exothermic chemical reaction

### [US9416625B2](#)

System and method for subsea structure obstruction remediation using an exothermic chemical reaction

### [US9255464B2](#)

System and method for subsea structure obstruction remediation using an exothermic chemical reaction

# Installation and Workover Control Systems (IWOCS)

## Product Description

An IWOCS is a temporary control system used to commission, workover, troubleshoot, or decommission subsea wells. Specialized equipment such as umbilical reels, hydraulic power units (HPUs), and winches are used to enable hydraulic and electrical control of subsea trees and related hardware.

## Patent(s)

[US9556685B2](#)

Inside riser tree controls  
adapter and method  
of use

[EP3283723B1](#)

Inside riser tree controls  
adapter and method  
of use

[US8215889B2](#)

System and method for  
high current recovery  
cursor



# Capping Stack

## Product Description

Capping stack grip and seal connectors are installed on and grip API 5CT casings. The connectors seal to a maximum operating pressure of 15 kpsi on casing sizes up to 14 in and 10 kpsi on casings up to 16 in. All operations of the connector are controlled from an ROV panel and operated via a 5,000 psi hydraulic hot stab. From the ROV panel, the connector can be cycled through grip actuation, seal actuation, seal integrity testing, seal release, and grip release.

## Patent(s)

[EP3283796A4](#)

Composite circular connector seal and method of use

[US10753170B2](#)

Composite circular connector seal and method of use



# CP Probe

## Product Description

The CP Probe easily interfaces with the ROV, but can also be held by divers. It serves as either a tip-contact or proximity-style probe, and if ROV operators want to avoid connection to the umbilical, the ROV interfaces with "C Meter Readout", providing a self-contained, direct subsea readout, viewable on the ROV's video camera. Like all CP probes, they are fully fieldserviceable, with plug-in electrode elements and interchangeable components.

## Patent(s)

[US10270386B2](#)

Photovoltaic powered  
cathodic protection  
probe

[EP3344797A4](#)

Photovoltaic powered  
cathodic protection  
probe



# Hot Tap

## Product Description

Smart Tap-Mechanical hot tap fitting: Our Smart Tap is a split, mechanical hot tap fitting that provides a flanged branch for hot tapping an existing subsea pipeline and tying-in a new lateral pipeline. The fitting effectively eliminates requirements for costly pipeline shut downs and expensive hyperbaric welding.



## Patent(s)

### [US11454343B2](#)

System for and method of sealing a flowline with a metal seal after hot tapping

### [US10989348B2](#)

System for and method of sealing a flowline with a metal seal after hot tapping

### [EP3507534A4](#)

System for and method of sealing a flowline with a metal seal after hot tapping

# Chain-Driven Diamond Wire Saw

## Product Description

Chain-Driven Diamond Wire Saw-Designed for cutting large subsea structures from 10–21 ft (3–6.5 m) OD and beyond .

## FEATURES

Installed and operated by ROV Smaller than other tools.

Cuts almost any size.

Cart is moved along the circumference, while the diamond wire rotates.

The pulley system contracts and extends to keep the wire in tension.

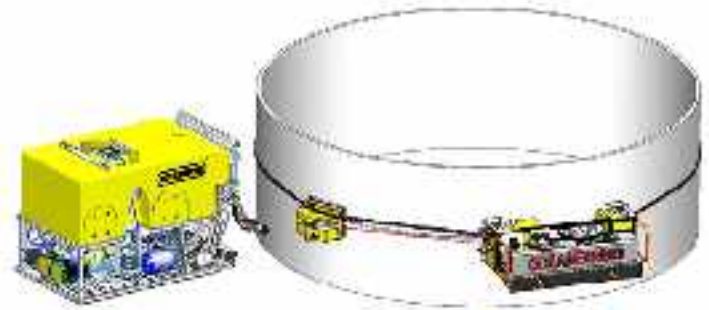
## Patent(s)

[US10322460B2](#)

Chain driven diamond  
wire cutter

[EP3512674A4](#)

Chain driven diamond  
wire cutter



# Well Intervention

## Product Description

The interchangeable riserless intervention system (IRIS) and the Blue Ocean riserless intervention system (BORIS) are designed to perform reliably in depths to 10,000 ft (3,000 m) and pressures to 10,000 psi.



## Patent(s)

[BR112012008998B1](#)

Subsea grease system and method of operating said system

[US8220553B2](#)

Subsea grease system and method of operating said system

[EP2494142B1](#)

Subsea grease system and method of operating said system

[US10352114B2](#)

Guide apparatus for tubular members in a snubbing unit

[US9822613B2](#)

System and method for riserless subsea well interventions

[US9970243B2](#)

Snubbing unit for inserting tubular members without a riser

[US20190024471A1](#)

Open water coiled tubing sealing device

[EP3655622B1](#)

Open water coiled tubing sealing device

[US11448030B2](#)

Open water coiled tubing sealing device

# Subsea Digital Radiography

## Product Description

Oceaneering subsea digital radiography capabilities provide customers with reliable non-destructive testing (NDT) techniques. Our processes are non-intrusive, do not require shutdown, and penetrate coatings to detect, size, and monitor flaws and anomalies.

## Patent(s)

[US10746673B2](#)

Inspection of grouting  
between monopile and  
transition piece on  
offshore wind turbines



# Coating Removal

## Product Description

High-Pressure Cleaning and Coating Removal: We combine abrasive waterjet technology and high-pressure pumping systems to provide high-pressure cleaning of marine growth from hulls, risers, strakes, and fairings. We have coating removal services for fusion bond epoxy (FBE), concrete weight coating (CWC), thermal insulation materials, and other protective sheathes.

## Patent(s)

[US10900295B2](#)

Flexible riser insulation removal tool for ultrasonic test inspection

[EP3720619A4](#)

Flexible riser insulation removal tool for ultrasonic test inspection



# Flowline Remediation System



## Product Description

The FRS is designed to interface with a number of subsea assets, but most notably provides a subsea interface for flowlines. The FRS handles large fluid volumes at increased flow rates and sits on the seafloor after being deployed from a vessel.

## Patent(s)

[US8413725B2](#)

Subsea fluid separator

[US9435185B2](#)

Subsea technique for promoting fluid flow

[US10161238B2](#)

Subsea technique for promoting fluid flow

# Surface Plug & Abandonment

## Product Description

Oceaneering can provide a vessel-based solution that requires no risers or divers, allowing cost effectiveness and flexibility for accommodating unknown challenges.

Typical programs includes the removal of Temporary Abandonment caps, the cut and pull of casings, the perforation and squeezing of cement, and setting the open hole to surface well barrier (environmental plug).

## Patent(s)

[NO332439B1](#)

Method and device for plugging of a subsea well

[GB2500323B](#)

Method and device for plugging of a subsea well

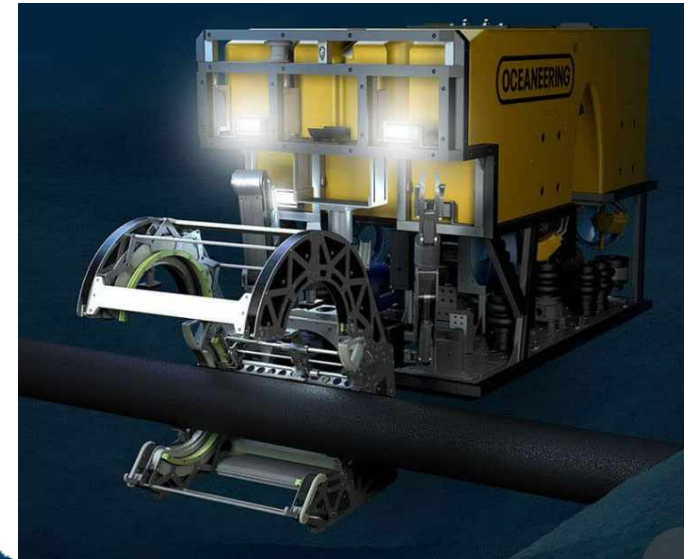


# Subsea Tomography/ Neptune

## Product Description

Neptune is a high-resolution ultrasonic testing tool designed and developed to examine welds, subsea pipelines, risers, and tubular structures.

Neptune's ROV-deployed technologies enable routine and project-specific ultrasonic inspection and provide cost-saving opportunities through reduced inspection time and reduced operational costs.



## Patent(s)

[US10641048B2](#)

Subsea automated ultrasonic testing

[EP3769066A4](#)

Subsea automated ultrasonic testing

[WO2019226524A1](#)

Subsea automated ultrasonic testing

[US10989673B2](#)

Subsea computed tomography system with flat panel detectors

[EP3769301A4](#)

Subsea computed tomography system with flat panel detectors

[WO2019217612A1](#)

Subsea computed tomography system with flat panel detectors

# Subsea Wellhead Removal

## Product Description

The Oceaneering Subsea Wellhead Picker offers an environmentally friendly alternative for severing and removing subsea wellheads without the requirement for a costly drilling rig.

The Subsea Wellhead Picker is a combination of a connector that latches onto the wellhead and the Internal Multistring Cutting Tool (IMCT).

The IMCT uses the extremely effective Abrasive Waterjet Cutting method to sever all the layers of casing in one go.



## Patent(s)

[GB2463849B](#)

Method and device for removing the upper portion of a well

[NO328322B1](#)

Lifting anchor

[AU2008293123B2](#)

Method and device for removing the upper portion of a well

[NO327223B3](#)

Method and device for removing the upper portion of a well

[ZA201001615B](#)

Method and device for removing the upper portion of a well

# Abrasive Waterjet Cutting (AWJC)

## Product Description

Our ROV-operated external cutting tool (ECT) enables external cutting of jacket legs, pipelines, and bracing, as well as subsea window cutting of tubulars. The tool uses a high-pressure slurry hose from the surface to feed the abrasive material. The ECT cuts 16-in to 72-in OD pipe, and can cut more than 10-in wall thicknesses (or several layers) at speeds up to 20 in/min.

## Patent(s)

[US7258597B2](#)

Subsea abrasive jet cutting system and method of use



# Diamond Wire Saw (DWS) Subsea Cutters

## Product Description

Diamond Wire Saw (DWS) Subsea Cutters are designed for the underwater cutting of horizontal or vertical pipes, and offer five models that cut pipe outside diameters (ODs) ranging from 4 in to 84 in (10 cm to 213.4 cm) (DN100–DN2100).

Running on hydraulic power, the diamond wire saw is controlled remotely by using the topside control panel (TCP) or by ROV control operable via zero leak hot stabs.

## Patent(s)

[US7406905B2](#)

System for driving a wire loop cutting element

[OA14431A](#)

IP intelligence | Patent intelligence software

[OA14430A](#)



# Smart Flange

## Product Description

Smart Flange Plus Connectors: Our field-proven connectors attach to and seal against the pipeline or riser to enable the safe completion of permanent subsea repairs, providing a robust, structural connection point subsea.

These connectors are capable of withstanding full pipeline axial, bending, and torsional loads while maintaining full line pressure integrity.

## Patent(s)

[US10145493B2](#)

Slip-on connector to grip and seal on smooth OD pipe/casing and method of use



# Hydraulic Gasket Pre-Load Tool

## Product Description

Hydraulic gasket pre-load tool. This exists as an option on the vertical flowline connector. Diverless Connection System - Vertical: Fast and reliable pipeline and flowline tie-ins.



## Patent(s)

[US10107418B2](#)

Subsea clamp  
tensioning system

[EP3430233A4](#)

Subsea clamp  
tensioning system

[US10193269B2](#)

Connector  
maintenance panel

[EP3464794A4](#)

Connector  
Maintenance Panel

# Subsea Pig Launchers and Receivers

## Product Description

Our subsea- and surface-loadable pig launchers can be operated remotely or via ROV, and eliminate the requirement for a service flowline. We deliver further flexibility through customizable configurations that accommodate various pig types and capacities. Our solution for remotely-operated subsea pig launching was awarded the Hart's E&P Special Meritorious Award for Engineering Innovation.

## Patent(s)

### [US7003838B2](#)

Hydraulic pig advance system comprising a control volume chamber containing hydraulic fluid and a force transmitting member



# Pipeline End Preparation



[US8220371B2](#)

Pipe turning tool

# Riser and Mooring Cleaning Tool/Skid

## Product Description

The ROV-operated tool removes marine growth without damaging an asset's protective outer coating.

The tool can be configured with various combinations of brushes and scraping tools for optimal performance.



## Patent(s)

[US7765632B2](#)

Subsea conduit cleaning tool

[US8689386B2](#)

Subsea conduit cleaning skid

[US9126239B2](#)

Subsea conduit cleaning skid and method

[US7971306B2](#)

Subsea conduit cleaning tool

# Flow Remediation System

## Product Description

The FRS is designed to interface with a number of subsea assets, but most notably provides a subsea interface for flowlines.

The FRS handles large fluid volumes at increased flow rates and sits on the seafloor after being deployed from a vessel.

## Patent(s)

[US8197577B2](#)

System and method for  
underwater oil and gas  
separator



# Mechanical Pipe Lift Frame



## Patent(s)

[US10815736B2](#)

Underwater SCR  
lifting frame

[EP3781778A4](#)

Underwater SCR  
lifting frame

[WO2019204690A1](#)

Underwater SCR  
lifting frame

# Port Vision

## Product Description

The Oceaneering PortVision 360 software as a service (SaaS) solution provides customers with a collaborative tool equipped with real-time and historical analytics of vessel movements gathered by leveraging vessels' public AIS signals.

## Patent(s)

[US7933693B2](#)

System and method for harvesting business intelligence from maritime communications

[CA2684868C](#)

System and method for harvesting business intelligence from maritime communications



# Unmanned Aircraft Systems

## Product Description

Oceaneering uses UAS to inspect difficult-to-access locations both onshore and offshore. This agile and optimized solution often eliminates the need for rope access teams or other means of access and effectively minimizes risk and increases uptime for asset operators.



## Patent(s)

[US20170269592A1](#)

Use of Unmanned Aerial  
Vehicles for NDT  
Inspections

[KR2019016484A](#)

Use of Unmanned Aerial  
Vehicles for NDT  
Inspections

# Millennium® Plus

## Heavy work class ROV

The Millennium® Plus ROV is a side entry cage deployed, dual manipulator 220 hp heavy work class ROV. The cage or Tether Management System (TMS) supplies an additional 110 hp and is capable of powering skids, and has thruster control and auto heading.



### FEATURES

**Fly-by-wire station keeping system**

**10,000 fsw / 3,000 msw depth rating (13,000 fsw / 4,000 msw optional)**

**220 hp**

## Specifications

### Vehicle Specifications

Weight in air	8,800 lb / 4,000 kg
Dimensions (LxWxH)	10.8 x 5.5 x 6.3 ft / 3.3 x 1.7 x 1.9 m
Depth rating	10,000 ft / 3,000 m (standard) 13,000 ft / 4,000 m (optional)

### Vehicle Power and Performance

Hydraulic power units	2 x 110 hp(E)
Propulsion	4 x vectored horizontal 4 X vertical
Thrust	
Forward/reverse:	2,000 lb / 900 kg
Lateral:	2,000 lb / 900 kg
Vertical:	2,080 lb / 950 kg

### Vehicle Manipulators and Tooling

Manipulators (2)	5 or 7 function: rate, SC, or hybrid control
Hydraulic Tool Control	Multiple directional control valves with proportional pressure and flow control Maximum 40 gal/min

### Vehicle Cameras and Lighting

Cameras	Standard definition (SD) High definition (HD) 3D HD (optional)
Lighting	Up to 8 x 250 W (quartz halogen or high-intensity LED)

### Vehicle Control and Navigation

Automatic control	Fly-by-wire station keeping system Auto heading/depth/altitude/pitch Cruise control
Heading and altitude sensors	Survey-grade gyro Backup flux gate compass
Depth sensor	High-resolution digiquartz Backup analog depth sensor
Navigation sensor	Doppler velocity log
Obstacle avoidance sonar	Kongsberg 1071 or 1171 Tritech SeaKing

### Vehicle Optional Power and Data Interfaces

Data links	Multiple RS232 and RS485 Ethernet Optical fiber
Power	24 V DC and 110 V AC

### Tether Management System (TMS)

Type	Side entry cage or top-hat
Propulsion	2 x horizontal (cage only)
Hydraulic power unit	1 x 110 hp(E)
Electro-optical tether	2,000 ft / 600 m (cage) 4,000 ft / 1,200 m (cage) optional 1,300 ft / 400 m (top-hat)
Cameras	2 x charge-coupled device (CCD)
Lighting	2 x 250 W (quartz halogen or high-intensity LED)

### Launch and Recovery Systems (LARS) (choice of)

Overboarding	
A-frame w/ or w/o docking head	
Heavy-weather overboarding system	
Cursor	
Winch	
Heavy lift winch with conventional or OHRA level wind	

# Magnum® Plus

## Heavy work class ROV

The Magnum® ROV is a side entry cage deployed, dual manipulator ROV that operates in water depths up to 10,000 fsw and in severe weather conditions. The cage or tether management system (TMS) supplies an additional 85 hp, powers skids, and has thruster control and auto heading.



### FEATURES

**Fly-by-wire station keeping system**

**10,000 fsw / 3,000 msw depth rating (13,000 fsw / 4,000 msw optional)**

**170 hp**

### Vehicle Specifications

Weight in air	6,750 lb / 3,060 kg
Dimensions (LxWxH)	8.5 x 5.1 x 6.1 ft / 2.6 x 1.6 x 1.9 m
Depth rating	10,000 ft / 3,000 m (standard) 13,000 ft / 4,000 m (optional)

### Vehicle Power and Performance

Hydraulic power units	2 x 85 hp(E)
Propulsion	4 x vectored horizontal 2 X vertical
Thrust	
Forward/reverse:	1,600 lb / 725 kg
Lateral:	1,750 lb / 800 kg
Vertical:	1,200 lb / 550 kg

### Vehicle Manipulators and Tooling

Manipulators (2)	5 or 7 Function: rate, SC or Hybrid Control
Hydraulic tool control	Multiple directional control valves with proportional pressure and flow control Maximum 25 gal/min

### Vehicle Cameras and Lighting

Cameras	Standard definition (SD) High definition (HD) 3D HD (optional)
Lighting	Up to 8 x 250 W (quartz halogen or high-intensity LED)

### Vehicle Control and Navigation

Automatic control	Fly-by-wire station keeping system Auto heading/depth/altitude Cruise control
Heading and altitude sensors	Survey-grade gyro Backup flux gate compass
Depth sensor	High-resolution digiquartz Backup analog depth sensor
Navigation sensor	Doppler velocity log
Obstacle avoidance sonar	Kongsberg 1071 or 1171 Tritech SeaKing

### Vehicle Optional Power and Data Interfaces

Data links	Multiple RS232 and RS485 Ethernet Optical fiber
Power	24 V DC and 110 V AC

### Tether Management System (TMS)

Type	Side entry cage or top-hat
Propulsion	2 x horizontal (cage only)
Hydraulic power unit	1 x 85 hp(E)
Electro-optical tether	1,800 ft / 550 m (cage) 4,000 ft / 1,200 m (cage) optional 1,300 ft / 400 m (top-hat)
Cameras	2 x charge-coupled device (CCD)
Lighting	2 x 250 W (quartz halogen or high-intensity LED)

### Launch and Recovery Systems (LARS) (choice of)

Overboarding	
A-frame w/ or w/o docking head	
Heavy-weather overboarding system	
Cursor	
Winch	
Heavy lift winch with conventional or OHRA level wind	



# NEXXUS

## Increased ROV and BOP intervention capabilities



The NEXXUS ROV raises the bar and exceeds API S53 specifications to solve demanding tooling intervention requirements.

### FEATURES

**Integrated API S53 compliant system**

**Full power available for ROV tooling**

**Unmatched high pressure / high flow tool control**

### Vehicle Specifications

Weight in air	10,500 lb / 4,750 kg
Dimensions (LxWxH)	10.9 x 5.6 x 6.3 ft / 3.2 x 1.7 x 1.9 m
Depth rating	10,000 ft / 3,000 m (standard) 13,000 ft / 4,000 m (optional)
Payload	1,000 lb / 455 kg

### Vehicle Power and Performance

Hydraulic power units	2 x 125 hp
Propulsion	4 x 380 mm vector horizontal 4 x 380 mm vertical
Thrust	
Forward/reverse:	2,300 lb / 1,050 kg
Lateral:	2,300 lb / 1,050 kg
Vertical:	3,100 lb / 1,400 kg

### Vehicle Manipulators and Tooling

Manipulators (2)	7 function proportional control: SC or hybrid
Wrist camera assembly	Laser, light, and camera

### Hydraulic Tool Control

HP supply	0-10 gal/min @ up to 15,000 psi
MP supply	60+ gal/min @ 5,000 psi (API S53 compliant)
LP supply	0-90 gal/min @ 3,000 psi
Reservoir capacity	200+ gal
Tooling space	40 ft <sup>3</sup> / 1.1 m <sup>3</sup>
Proportional tooling valves (11)	(8) 35 gal/min (2) 2 gal/min (1) max flow

### Vehicle Cameras and Lighting

Cameras	Standard definition (SD) High definition (HD) 3D HD (optional) 4K UHD (optional)
Lighting	Up to 8 x 250 W (high-intensity LED)

### Vehicle Control and Navigation

Automatic control	Autonomous control of the ROV Hands-free piloting Fly-by-wire station keeping system Auto heading/depth/altitude/pitch Cruise control
Heading and altitude sensors	Survey-grade gyro Backup flux gate compass
Depth sensor	High-resolution digiquartz Backup analog depth sensor
Navigation Sensor	Doppler velocity log
Obstacle Avoidance Sonar	Kongsberg 1071 or 1171 Tritech SeaKing

### Vehicle Optional Power/Data Interfaces

Data links	Multiple RS232 and RS485 Ethernet Optical Fiber
Power	24 V DC and 110 V AC

### Tether Management System (TMS)

Type	Side entry cage or top-hat
Propulsion	2 x horizontal (cage only)
Hydraulic power unit	1 x 125 hp
Electro-optical tether	2,000 ft / 600 m (cage) 4,000 ft / 1,200 m (cage) optional 1,300 ft / 400 m (top-hat)
Cameras	2 x charge-coupled device (CCD)
Lighting	2 x 250 W (high-intensity LED)
Options	4 thruster config on cage for DP Multibeam sonar as an option

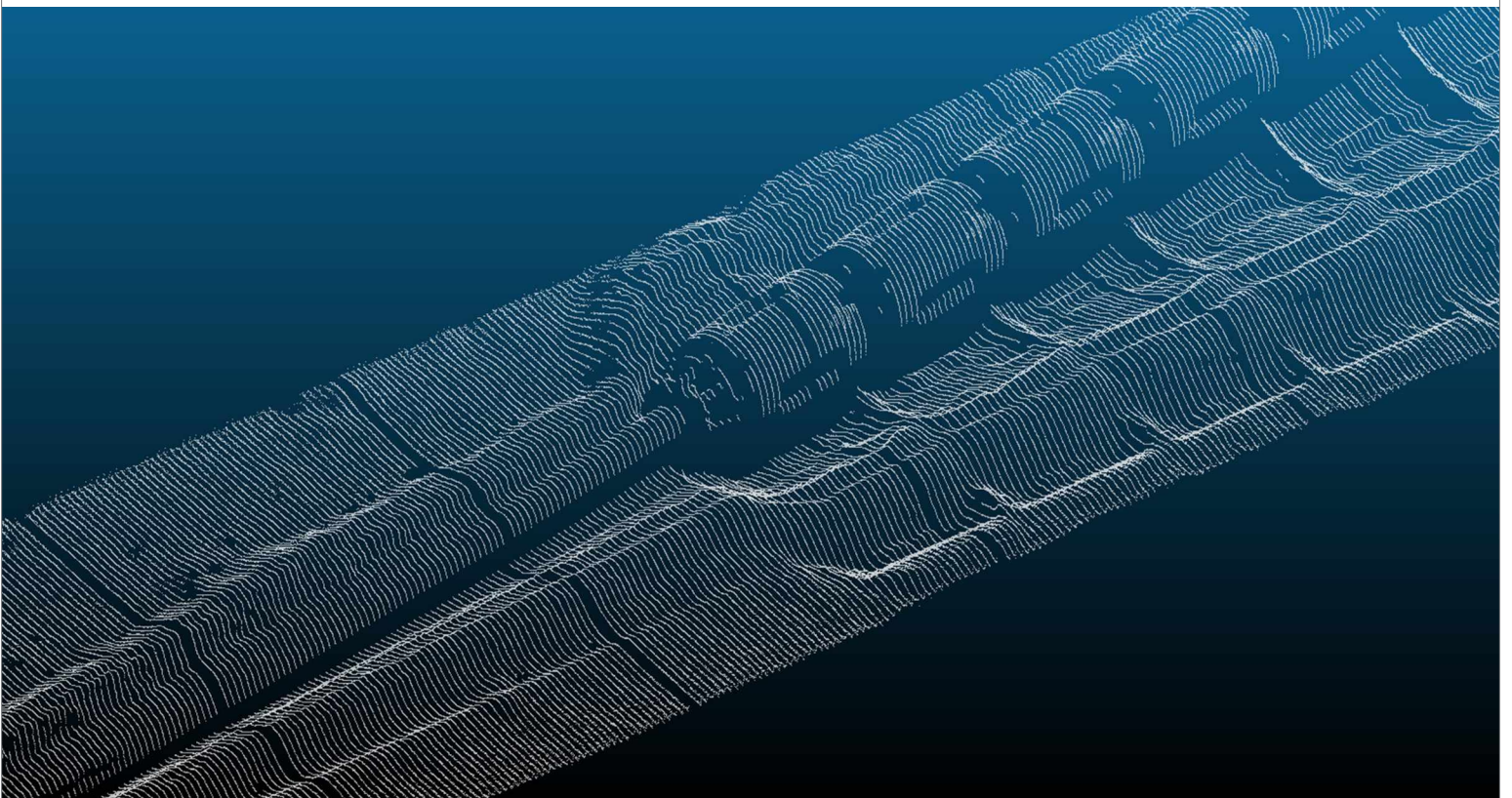
### Launch and Recovery Systems (LARS) (choice of)

Overboarding	
A-frame w/ or w/o docking head	
Heavy-weather overboarding system	
Cursor	
Winch	
Heavy lift winch with conventional or OHRA level wind	



[oceaneering.com](http://oceaneering.com)

# Deepwater AUV Pipeline Inspection



Oceaneering provides high-resolution pipeline inspection services with its fleet of O-Surveyor autonomous underwater vehicles (AUVs).

Connecting What's Needed with What's Next™

# Deepwater AUV Pipeline Inspection Services

O-Surveyor inspection AUVs support rapid in-field and pipeline corridor surveys with and offer a number of advantages:

- » Standard survey speed 3 to 4 kn
- » Seafloor bottom time  $\pm 36$  to 40 hours
- » Survey altitude of 26.2 ft/8 m
- » Ultra-short baseline (USBL) aided inertial navigation system (aINS)

The O-Surveyor inspection AUV was the first to carry a high-resolution laser bathymetry system rated to 14,760 ft/4,500 m. The laser operates at 29 kHz with a 5 mm profile resolution output every 7-10 cm.

The EM 2040 multibeam provides a 140° swath operating at 400 kHz, yielding a 28 m swath with a data bin size of 0.3 m.

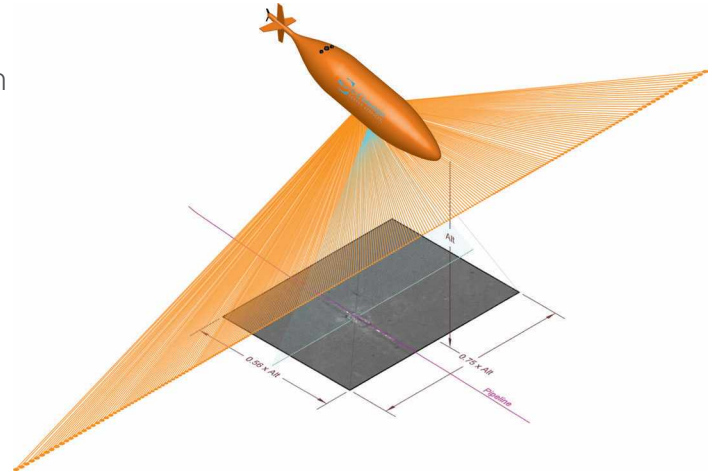
The proprietary camera system provides a 6 m x 4.5 m picture every 1.75 seconds, including a 30% overlap between each picture at a 5 mm resolution. The images support high-resolution geo-referenced mosaics, pseudo-video creation of pipeline routing, and subsea infrastructure.

The geo-referenced still photo imagery, laser data, and multibeam data enable change detection across surveys.



## Custom Equipment:

- » Kongsberg Simrad EM 2040 Multibeam Echosounder
- » Oceaneering proprietary high-resolution digital camera
- » 2G Robotics high-resolution laser bathymetry system
- » Magnetometer
- » Geochemical suite of sensors



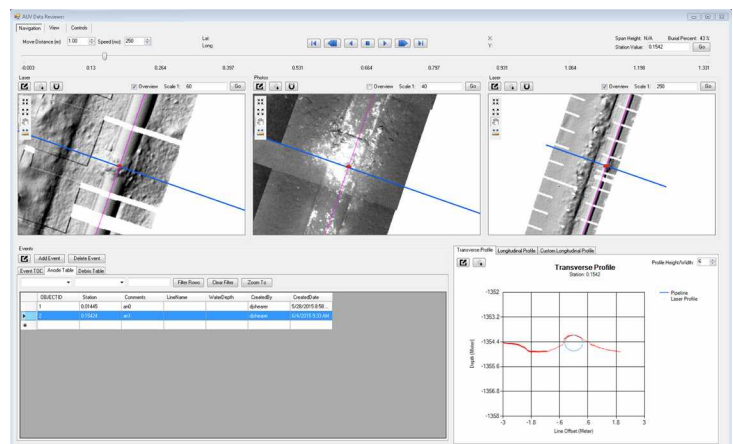
All inspection sensors are in addition to the vehicle's standard EdgeTech 120/410 kHz side scan sonar and 1-6 kHz sub-bottom profiler.

## Reporting Services

Oceaneering uses proprietary software developed for data processing and delivery. Customers receive a hard drive with all data collected and a copy of the viewing software.

## Data provided includes:

- » Photo mosaics
- » Annotated video of all still images taken during survey
- » Merged multi-beam data
- » List of events found along the survey route
- » Five-point file
- » Profile at specified intervals



All data is presented in ArcGIS format and the software allows you to view data, cut profiles, and take measurements to write out to a file.

The event log allows you to select an event, which then moves all three data sets to that point.

A unique attribute list can be pre-loaded to the software for use while classifying all events along the pipeline.

- For more information: [oceaneering.com/survey](http://oceaneering.com/survey)



[oceaneering.com](http://oceaneering.com)



[oceanengineering.com](http://oceanengineering.com)

# Protective Coating Removal Tools

Models 420, 1636, and 3264

The protective coating removal tools (PCRT) are an effective and efficient means of removing coating on pipelines. Our product portfolio includes tools to address pipe sizes ranging from 4 to 64 inches. The PCRT uses high pressure water to remove concrete weight coat (CWC), fusion bonded epoxy (FBE), coal tar epoxy (CTE), and other protective coatings commonly found on subsea pipelines.



## FEATURES

Capable of removing 3.6 ft / 1.1 m of coating in 360° in one circumferential pass

Interchangeable jetting heads for customized performance

ROV- and diver-operable solution

Connecting What's Needed with What's Next™

# Protective Coating Removal Tools

The tools are fully automated with integrated hydraulic controls that enable Oceaneering operators to control the linear and circumferential motion through a graphical user interface (GUI). The tools are also equipped with several redundant features to maximize cleaning time and mitigate down time. In order to optimize the monitoring and performance of the tool, the PCRT comes standard with LED cameras, providing an enhanced overview of the cleaning process.

- » Two jetting nozzles for faster, more efficient cleaning
- » Can be supplied with buoyancy to aid flotation stability
- » Can alternate from linear to a circumferential motion
- » Fully-automated ROV controls, if required
- » Custom sizes available for larger pipes, upon request

## Technical specifications

Hydraulic Supply (ROV option)		Hydraulic Umbilical Supply (Diver option)	
Pressure	3,000 psi / 206 bar	Eight core hydraulic umbilical with two high-pressure water lines	
Flow rate	10 gal/min 40 L/min	Pressure	3,000 psi / 206 bar
Hydraulic connection	17H dual-port hot stab	Flow rate	10 gal/min 40 L/min
Electrical Supply (ROV option)		Electrical Umbilical	
Voltage	24 VDC	Maximum working pressure	20,000 psi / 1,500 bar
Amperage	6 A	Powers four cameras via wet-mateable connection	
Communication	RS-232		24 VDC, 6A, coaxial
Cleaning Area			
Linear	3.6 ft / 1.1 m		
Circumferential	360°		
Depth limitation	656 ft / 200 m		

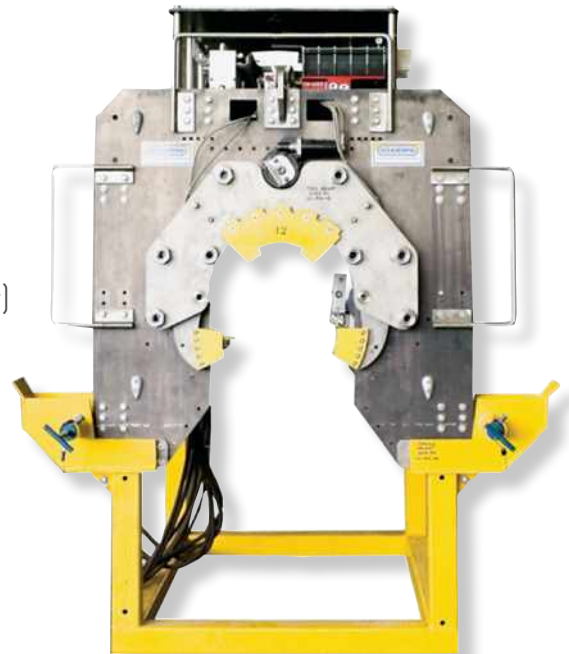
	PCRT 420	PCRT 1636	PCRT 3264
Pipe compatibility (maximum OD)	4 to 20 in	16 to 36 in	32 to 64 in
Weight	1,500 lb / 680 kg	2,800 lb / 1,270 kg	3,800 lb / 1,724 kg
Dimensions (L x W x H)	64 x 47 x 98.4 in / 162.2 x 120 x 250 cm	96.7 x 71.5 x 81.4 in / 245.6 x 181.6 x 206.8 cm	137.8 x 131.5 x 145.7 in / 350 x 334 x 370 cm
Control van dimensions (L x W x H)	240 x 94.5 x 102.4 in / , 6.1 x 2.4 x 2.6 m		
Control van weight	35,274 lb / 16,000 kg		
Spares van dimensions (L x W x H)	118.1 x 94.5 x 94.5 in / , 3 x 2.4 x 2.4 m		
Spares van weight	22,046 lb / 10,000 kg		
Hose reel dimension (L x W x H)	75 x 79 x 80 in / , 1.9 x 2 x 2 m		
Hose reel weight	11,000 lb / 5,000 kg		
Diesel HPU dimension (L x W x H)	106 x 43.3 x 66.9 in, 270 x 110 x 170 cm		
Diesel HPU weight	3,307 lb / 1,500 kg		
Diesel-driven, high-pressure pump dimensions (L x W x H)	117.8 x 96 x 96 in / , 299.1 x 243.8 x 243.8 cm		
Diesel-driven, high-pressure pump weight	22,046 lb / 10,000 kg		
Overboarding chute dimensions (L x W x H)	54.5 x 52.6 x 137.4 in / , 138.5 x 133.5 x 349 cm		
Overboarding chute weight	772 lb / 350 kg		

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# Coating and Weld Seam Removal Tool

The tool removes the pipe coating and factory weld seam in preparation for repair, tie-in, and inspection scenarios. It uses scrubbers to effectively remove a variety of coatings including FBE (fusion bonded epoxy) and PTFE (polytetrafluoroethylene) up to 3/16 in thick. An Oceaneering proprietary milling tool is used to mill the longitudinal factory weld seams.

The tool integrates with all work class ROVs capable of providing serial communications and a 24 V supply to the onboard, 5 station hydraulic valve pack (process solenoid valves with flow control). Oceaneering technicians control the tool via a topside laptop and custom software controls.



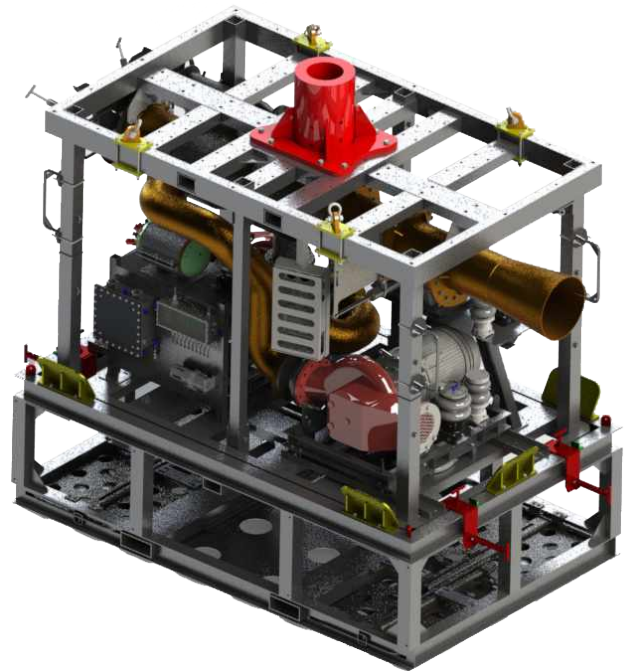
## Specifications

Hydraulic valve pack		Modular buoyancy (added to aid in deployment, if requested)	
Electric supply	24 V @ 5 A	Density	33 lb/ft <sup>3</sup>
Communications	Serial RS232	Weight in air	3,500 lb / 1,588 kg
Maximum hydraulic pressure	3,000 psi	Weight in water	2,900 lb / 1,315 kg
Hydraulic flow	10 gal/min (minimum)		
Tool weight		Dimensions	
In air	2,650 lb / 1,202 kg	Tool size	Cut / Clean Range (Pipe OD)
In water	2,400 lb / 1,089 kg	Small	10 in to 18 in
		Large	20 in to 24 in

# 12 Inch Electric XL Dredge

Superior deepwater dredging  
capability

The second generation 12 inch XL electric dredge provides 12.5k psi suction pressure and up to 7,500 suction gal/m. A topside control unit manages all dredge functions and monitors readings.



## FEATURES

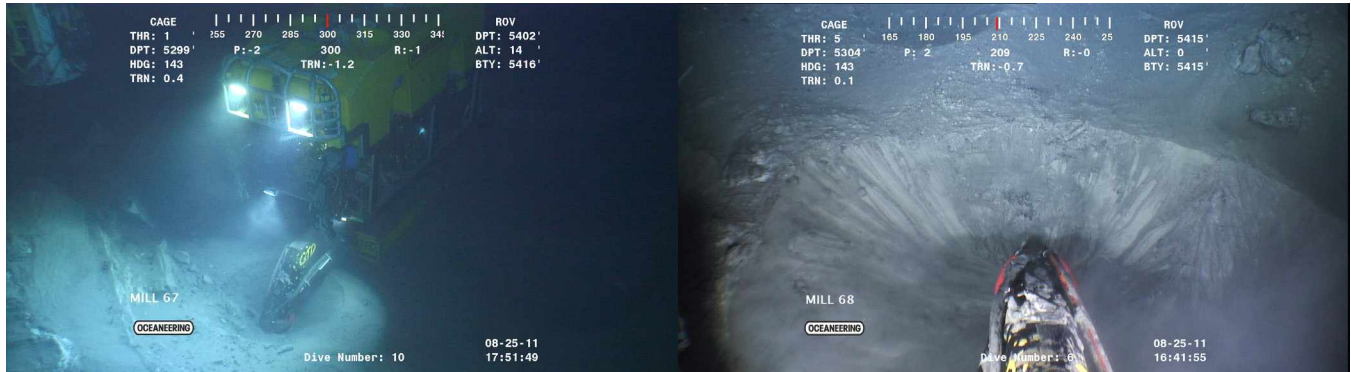
Full telemetry system

Cameras and lights monitor discharge

System's vital signs monitored by digital inputs

# 12 Inch XL Gen 2 Electric Dredge

## Superior deepwater dredging capability



### Capabilities

- » Removes soil from a specific area and transports it to a discharge site in a controlled manner
- » Provides the customer with varied techniques to meet the demands of numerous soil types of differing densities
- » Suction only: Provides suction with a single jet or suction with a high-pressure jetting ring
- » High-pressure jetting: Stiffer soils require high-pressure water jetting to loosen them and make available for transport
- » Low-pressure, high-volume jetting: Some soils require low-pressure, high-volume jetting to complete fluidization in order to complete transport

### Benefits

- » Allows for spoils to pass unprocessed
- » Transports rocks and large debris of approximately 1/2 in smaller than hose diameter
- » No moving components exposed to transport materials, providing greater durability and reliability
- » No depth limitations, constant suction, and no loss of hydraulic horsepower due to hydrostatic effect
- » Dual pump configuration for redundancy

### Applications

- » Drill cuttings remediation
- » Precision dredging around delicate assets
- » Seabed excavation and leveling
- » Subsea field clean-up
- » Pipeline excavation and burial

### Dredge Specifications

Fully Electric System	
Suction power	Approximately 7,500 gal/m Supplied by two 150 hp pumps
Jetting power	Approximately 550 gal/m at 130 psi Supplied by a 100 hp pump
Skid weight	10,000 lb / 4,536 kg
Skid dimensions (LxWxH)	132 x 72 x 80 in 335 x 182 x 203 cm
Mudmat dimensions (LxWxH)	129 x 83 x 36 in 328 x 211 x 91 cm
Control van dimensions (LxWxH)	96 x 96 x 144 in 244 x 244 x 365 cm
Portable control module	
10,000 ft / 3,000 m depth rating	
Deployment / Recovery	
Deep water	LARS (launch and recovery system), winch deployed, or crane deployed Umbilical to surface for power
Shallow water	Via crane or tugger tether over side for power

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# MagIQ SZ200 Scanning System

## Splash Zone Inspection Services

Oceanengineering, in collaboration with InnetiQs, offers the MagIQ SZ200 Scanning System which enables both internal and external splash zone inspection of risers, caissons, conductors, and structures.

The system provides a next-generation, unique NDT and inspection technology solution capable of gathering data through thick coatings or through corrosion resistant clad, without removing the coating or clad. The scanner offers high inspection sensitivity to isolated pitting, is rapidly deployed, and benefits from a smooth transition into the splash zone without breaking continuity of inspection. The system easily meets the requirements of DNV RP F101, complimenting Oceanengineering's fitness for service engineering capabilities, including those for flexible risers.



### FEATURES

**Inspects up to 25mm thick pipe through up to 15mm external coatings and up to 4mm Monel clad**

**Greater than 90% Probability of Detection (PoD)**

**Fast scanning for external and internal corrosion mapping**

# MagIQ SZ200 Scanning System

## Splash Zone Inspection Services

The MagIQ SZ200 incorporates multiple unique high-resolution sensor arrays and operates using high-frequency, partial saturation eddy currents to enable detection and sizing of internal and external defects, particularly in areas with higher wall thickness and coating ranges or clad in place. The system can integrate additional features including an ultrasonic sensor array and advanced cleaning system that can be used to simultaneously remove marine growth during inspection.

The scanner is easily deployed using rope access support and the all-in-one solution with onboard electronics omits the need for a topside-attached umbilical and associated cable-handling implications.

## Technical Specifications

Installation method	Topsides by rope access; scans through splashzone; wave impact resistant
<b>Capabilities</b>	
Wall thickness range	Up to 1 in / 25.4 mm - higher WT on request
Coating thickness range	Up to 0.59 in / 15 mm (thicker if thinner pipe wall)
Clad thickness range	Up to 0.16 in / 4 mm (stainless, Monel)
Diameter range	6 in / 15.2 cm to flat
Depth threshold for detection	Defects $\geq$ 10% WT wall loss (external or internal)
Defect detection	Smallest calibration defect detection setup: From 0.2 in / 5 mm diameter at depth threshold of 20%WT for far side wall defects
Sizing accuracy	+/- 5-10% of nominal wall thickness
Defect location – ID/OD separation	External from internal defects with separate external / internal mapping report
Depth rating	984 ft / 300 m (deeper on request)
<b>Dimensions</b>	
Weight	441 lb / 200 kg in air ~287 lb / 130 kg in water
L x W x H	37.4 x 21.7 x 17.7 in 950 x 550 x 450 mm

<b>Hardware</b>	
Sensors (MagControl EC)	16 sensors in circumference with 200mm scan width
Sensors (UT) - optional	Multiple UT sensor array 8 or 16 UT channels operating at 4 MHz
Magnetization unit	Cooled and stabilized electromagnet
Electronics	Incorporated into the scanner – no need for an umbilical
Camera	2 off (front/rear for operational and visual inspection support)
Umbilical	Via standard spooler – 230 ft / 70 m (longer length on request)

<b>Access Requirements</b>	
Required clearance	Dependent on tool setup: 19.7 in / 500 mm external space required to allow for axial scanning
Coating/cladding	No requirement for coating or cladding removal
Marine growth	Heavy marine growth must be removed

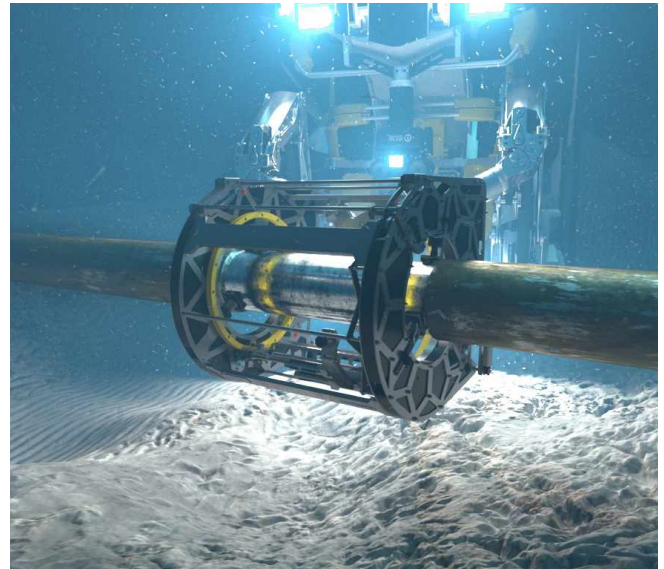
<b>Data Analysis and Reporting</b>	
Reporting	Inspection report and matrix data

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# Neptune

## ROV-deployed ultrasonic testing tool

Neptune is a high-resolution ultrasonic testing tool designed and developed to examine welds, subsea pipelines, risers, and tubular structures. Neptune's ROV-deployed technologies enable routine and project-specific ultrasonic inspection and provide cost-saving opportunities through reduced inspection time and reduced operational costs.



### FEATURES

**Deepwater capability to 10,000 ft / 3,000 m**

**Multiple advanced ultrasonic testing (UT) techniques available**

**Work or inspection class ROV-deployable**

# Neptune

## ROV-deployed ultrasonic testing tool

Neptune performs high-resolution wall thickness mapping, time-of-flight diffraction (ToFD), and phased array weld inspection using multi-element, depth-rated transducers. The hardware and software developed in-house allow real-time data to be transferred topside via an ROV umbilical. Neptune's design provides operators with an alternative to traditional inspection methods.

The neutrally-buoyant Neptune system is deployed via an inspection or work class ROV and delivers high-quality, automated inspection data and imaging. Using this data, operators can complete fracture mechanic analysis and assess the remaining life of subsea assets.

The Neptune system can be provided with an ROV or as a stand-alone inspection solution capable of interfacing with the customer's ROV.

### Applications

- » Integrity inspections of subsea risers, pipelines, and manifold piping
- » Follow-up inspections after pigging inspection activities
- » Underpinning routine subsea visual inspections
- » Pre-hot-tap integrity control solutions

### Benefits

- » HSE: The equipment is ROV-deployed and can replace diver-completed operations
- » Cost Savings: The system is operated by an inspection or work class ROV and can be launched from the offshore installation. Performing the operation without the aid of a diving support vessel (DSV) can dramatically reduce operational costs
- » Inspection Quality: The high-definition mapping and weld inspection capabilities of the Neptune system provide valuable engineering information, ensuring accuracy of life expectancy calculations

### Technical Data

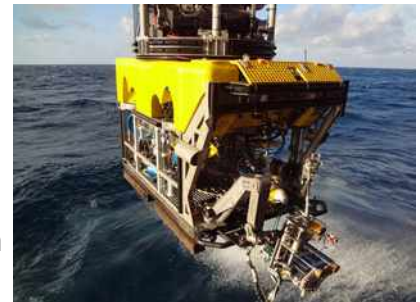
<b>Design depth maximum</b>	<b>10,000 ft / 3,000 m</b>
Surface transfer	Fiber optic / Ethernet
Weight	Neutrally buoyant in water
Inspection area	360° Y axis / 500 mm X axis
Inspection resolution mapping	1 mm step on both axes
Weld inspection methods	time-of-flight Diffraction (ToFD) / phased array / pulse echo
Launching	From offshore installation or vessel
Asset dimensions suitable for inspection with standard tooling	6 in - 20 in
Wall thickness of item being inspected	No limitations

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# Subsea Digital Radiography

## Computed or Digital Detector Array

The boundaries of oil and gas exploration continue to push production facilities into deeper water, presenting new challenges for operators requiring integrity assurance of their assets. Challenging conditions arise from working with a more corrosive product, higher pressures and temperatures, thicker fluids, and high flow rates. Inspection demands for testing of corrosion resistant alloy linings, thicker pipes, and through thicker external thermal insulation combine to further limit inspection options.



Oceanengineering subsea digital radiography capabilities provide customers with reliable non-destructive testing (NDT) techniques. Our processes are non-intrusive, do not require shutdown, and penetrate coatings to detect, size, and monitor flaws and anomalies.

### FEATURES

**Instant radiographic images (DDA radiography)**

**Adaptable to most pipe sizes, no need to remove coatings**

**Enhanced contrast, measurement and magnification**

# Subsea Digital Radiography

## Computed or Digital Detector Array

**Oceaneering, working with a leading supplier, successfully customized digital radiography equipment capable of delivering integrity information in depths up to 10,000 feet (3,048 meters).**

### A Digital Solution

Subsea digital radiography is one solution that helps our customers address shallow and deepwater asset integrity needs. This unique service can be provided by computed radiography (CR) or digital detector array (DDA) systems, depending on factors including water depth and the integrity issue being addressed.

DDA produces a radiographic image which is instantly relayed to a topside monitoring and data collection system via a fiber-optic link. The assembly is operable subsea at very high pressures due to the inclusion of GE DDA flat panel detector technology, developed specifically for placement and deployment in a marinized housing.

CR produces a radiographic image following exposure to a rigid or flexible phosphor imaging plate. The plates are placed in special vacuum-packed, static-free cassettes, scanned on the vessel, and interpreted using high resolution monitors.

### Applications

- » Identification of erosion and corrosion
- » Foreign object detection
- » Detection of pipeline blockages
- » Assessment of valve operational issues

### Radiation Exposure Systems

#### Gamma

The Sentinel Model 865 Radioisotope Exposure Device is a portable industrial radiographic exposure system. The basic system consists of a camera and a pneumatic control unit. The system may be loaded with up to 240 Curies (8.88 TBq) of Iridium-192.

### High Energy X-ray

A marinized, high-energy x-ray system is used to produce an x-radiation source in deep water. This method is typically more suited to higher attenuating applications including inspection of thicker and larger diameter pipes, concrete coatings, or valves.

The marinized detectors are typically incorporated into a handling tool assembly custom developed to position the radiation source and detector on the item under test. The systems can be deployed by divers or a work-class ROV.

### Detection Media

The use of digital inspection technology enables shorter exposure times and instant image review and analysis. The GE Rhythm™ and Flash!Filter™ software reduces the need for re-shooting of images, enabling increased productivity and production of clear, and concise images for easier interpretation:

- » Gray levels map linearly to dose enabling wall thickness measurements when using proper calibration strategies.
- » Active imaging area is 16 x 16 in (41 x 41 cm) for DDA and either 13.7 x 16.9 in (35 x 43 cm) or 7.9 x 7.9 in (20 x 20 cm) for CR.

### Other Features

- » Wall thickness analysis
- » Wide exposure latitude allows multiple thicknesses to be covered in a single exposure

# Trident System

## Diver-deployed automated ultrasonic testing

Trident is a diver-deployed, high-resolution, subsea automated ultrasonic testing (AUT) scanner. The scanner was developed in-house and is designed to inspect pipelines, risers, jumpers, and other tubular structures at depths down to 984 ft (300 m).

Trident's UT technology enables high-resolution, real-time inspection via a fiber-optic umbilical. Inspection using the Trident scanner provides cost-savings through reduced time on site by using phased array transducers for corrosion mapping and weld inspection.



### FEATURES

**Multiple advanced UT techniques available**

**Rapid and cost-effective scanning capability**

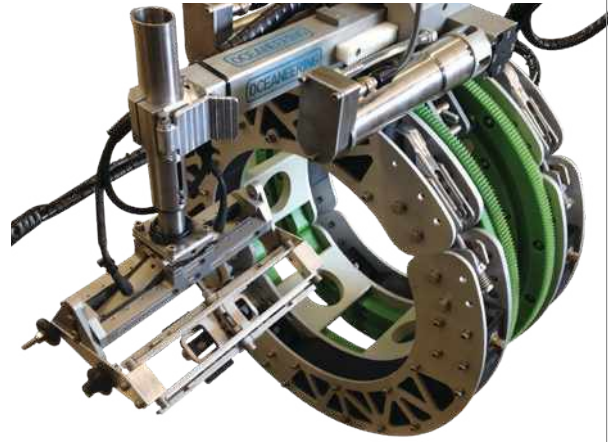
**Real-time data acquisition**

# Trident

## Diver-deployed ultrasonic imaging tool

Trident can be deployed with pulse echo, time of flight diffraction (ToFD), or phased array UT (PAUT) transducers, as the customer's application dictates. The depth-rated transducers deliver high-resolution wall thickness mapping and weld inspection. This high-quality, automated inspection data enables customers to perform fracture mechanic analysis and remaining-life assessments on their assets.

Trident performs a full 360° inspection along a 20-in (508-mm) axial length per location in either the horizontal or vertical position. The diver can quickly unlatch Trident from the pipe for redeployment to a new inspection location. The system is mobilized with the scanner, subsea electronics pod, umbilical, 100% spares, and topside control laptop.



## Applications

- » Inspection of flexible pipes for flooded/non-flooded annulus condition
- » Determining the remaining tensile armor wire thickness of flooded flexible pipes
- » Corrosion mapping of pipelines, flowlines, jumpers, and risers
- » In-line inspection (ILI) verification
- » Weld inspection
- » Crack detection

## Technical Data

Item	Capability
Design depth	984 ft / 300 m
Surface transfer	Fiber optic / ethernet
Weight in air	66 lb / 30 kg
Umbilical	984 ft / 300 m
Inspection area	360° Y axis / (19.7-in) 500-mm X axis
Inspection resolution mapping	.04-in (1-mm) step on both axes
Weld inspection	Weld inspection using ToFD, PAUT, and combined ToFD/PAUT
Launching	From offshore installation or vessel
Inspection diameters	6-42 in (152-1067 mm)
Thickness of item being inspected	No limitations

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# Smart Flange Plus

## Permanent pipeline and riser repair

Our Smart Flange Plus connectors enable the safe completion of efficient permanent pipeline and riser repairs. The catalog of connectors has been used to complete thousands of global installations in shallow to ultra-deepwater applications. The flanges effectively eliminate the need for costly hyperbaric welding.



### FEATURES

**Fully mechanical, easy-to-install design**

**Lightweight and compact**

**Offshore subsea and topside applications**

Connecting What's Needed with What's Next™

# Smart Flange Plus

## Permanent pipeline and riser repair

Oceaneering developed the Smart Flange Plus connectors for various offshore applications including:

- » Pipeline spool piece repairs
- » Pipeline reroutes
- » Pipeline abandonments
- » Riser repairs
- » Structural repairs
- » Valve installations
- » Tee installations

Available worldwide, Smart Flange Plus connectors are stocked in a variety of sizes to accommodate asset diameters of 2 to 24 inches. Specially-designed connectors up to 48 inches have been delivered and installed.

Benefits of using the Smart Flange Plus connector to complete repairs include:

- » No requirement for hotwork permits
- » Elimination of straight pipe and riser cuts
- » Requires minimal pipe preparation
- » Connectors can be seal tested
- » Accepts external loading

### Design Parameters

Nominal pipe size (NPS): Any API Specification 5L pipe and wall thickness

Service: Standard (i.e. crude oil, natural gas, hydrocarbons, water or chemical injection, etc.)

Design pressure rating: up to ANSI Class 2500, up to API Class 10000

Design Temperature Range: 25° F to 250°F / -4°C to 121°C

Design Life: 25 years

### Material Specifications

Housing with weld neck flange (RTJ): ASTM A105, ASTM A694 F60 forging

End cap: ASTM A105, ASTM A694 F60 forging

Piston, slip anchor, and cone: AISI 4140 forging

Elastomer seals: Viton B or Buna-N

Studs and nuts: ASTM A193 Gr. B7 studs and ASTM A194 Gr. 2H heavy hex nuts, all Xylan coated (i.e. PTFE, dark blue)

External coating: Carboline® 890 marine epoxy paint system, safety yellow color

### Applicable Design Codes, Standards, and Specifications (latest editions)

ISO 9001:2000 Quality Assurance – Quality Control Procedures and Oceaneering PCRS Operating Procedures

ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 and 2

ASME B31.4, Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids

ASME B31.8, Gas Transmission and Distribution Systems

ASME B18.2.1, Square and Hex Bolts and Screws Inch Series

API 5L, Specification for Line Pipe

API 6A, Specification for Wellhead and Christmas Tree Equipment

API 6H, Specification on End Closures, Connectors, and Swivels

NACE MR0175, Sulfide Stress Cracking Resistant Metallic Materials for Oilfield Equipment

### Certifications

Bureau Veritas (BV) Oil and Gas Type Approval Certificate

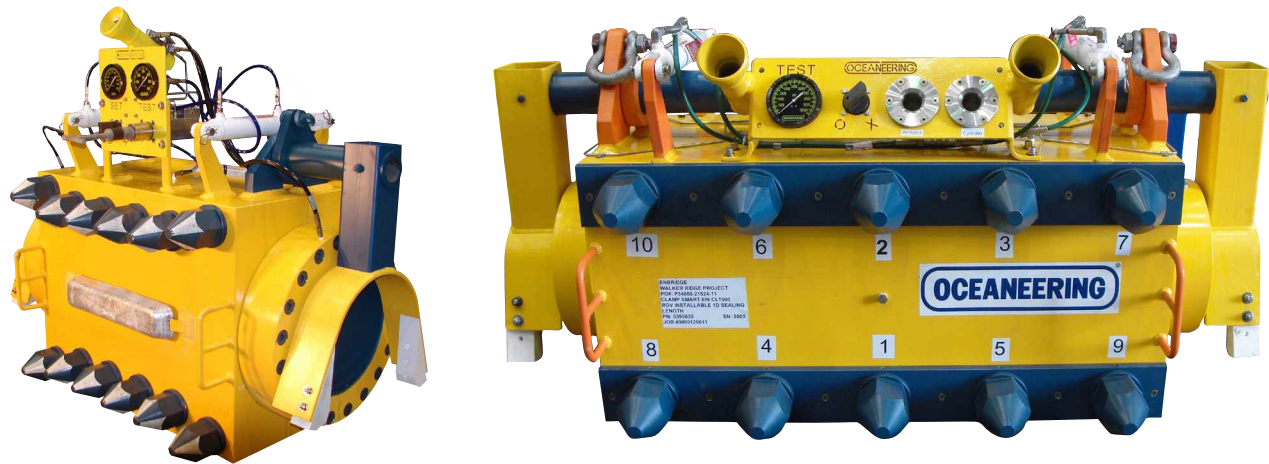
ISO 9001:2008 – World Certification Services Ltd. – Accredited by UKAS Quality Management

DNV GL Type Approval Certificate

# Diverless Smart Clamp

## Permanent pipeline repair solution

The diverless Smart Clamp is a split mechanical fitting used to repair a damaged or leaking subsea pipeline. The fitting eliminates costly pipeline shut downs and expensive hyperbaric welding associated with alternative repair methods. After installation, the Smart Clamp design provides a permanent, high-quality seal and structural reinforcement for the duration of the design life of the pipeline.



## FEATURES

Available in structural and non-structural configurations

Provides pressure containment within the encapsulated area

Cost saving, effective repair method

# Diverless Smart Clamp

## Permanent pipeline repair solution

Our structural and non-structural configurations ensure we meet diverse permanent pipeline repair requirements. Typically, the non-structural version is used to repair a pipeline that is structurally sound and has only minor damage such as pinhole leaks, local pipe wall thinning, or shallow dents. The structural clamp uses a grip and bowl mechanism to provide structural integrity to more severely damaged pipelines with defects including cracked girth welds, kinks, or punctures.

**Installation of the diverless smart clamp is achieved using hydraulic setting functions operated via an ROV panel with API 17D interfaces. The typical sequence involves:**

- » Lifting and supporting the damaged pipeline using a mechanical pipe lift frame
- » ROV deployment and positioning of the clamp above the damaged section
- » Opening the clamp via a hot stab using ROV pressurizing cylinders
- » Lowering the clamp onto repair area with pipe saddle assistance
- » Closing the clamp with ROV depressurization of the clamp via the hot stab
- » Tightening of the body studs using the ROV and modified hydraulic torque wrench
- » ROV intervention via second hydraulic coupling to simultaneously pressurize actuator flanges and set grip and seal mechanisms
- » Completion of ROV annulus testing to verify sealing integrity of the clamp



### Design Parameters

Nominal pipe size (NPS): Any API Specification 5L pipe and wall thickness

Service: Standard (i.e. crude oil, natural gas, hydrocarbons, water, or chemical injection, etc.) and sour (i.e. hydrogen sulfide, carbon dioxide, etc.)

Design pressure rating: up to ANSI Class 2500

Hydrostatic test pressure (minimum): 1.5 x design pressure rating rounded up to nearest 25 psig

Hydrostatic test duration (minimum): 4 hrs

Design temperature range: 25°F to 250°F / -4°C to 121°C

Water depth (maximum): 10,000 fsw / 3,048 msw

Design life: 25 years

Length between tension grips: The greater of 12 in or nominal pipe diameter

Internal diameter at center of clamp: Design standard is pipe outside diameter +1.625 in

Hydraulic cylinder pressure (maximum): 2,500 psi (172 bar)

Hydraulic actuator flange pressure (maximum): 10,000 psi (690 bar)

### Material Specifications (Primary Components)

Body, actuator flanges, and pusher rings: ASTM A105 forging

Load ring and ratchets: AISI 630 (17-4 PH), hardened

Tension bowl and grips: AISI 4140 hardened, electroless nickel plated

Compression rings and structural attachments: carbon steel

Seal extrusion guards: 316 stainless steel

Elastomeric circumferential and longitudinal seals: Viton-B, 70/80 durometer

Screws and studs: ASTM A193 Gr. B7, all Sermagard® coated for low friction and corrosion protection

Anode(s): Galvalum III

Internal coating (ferrous components): Phosphate and oil

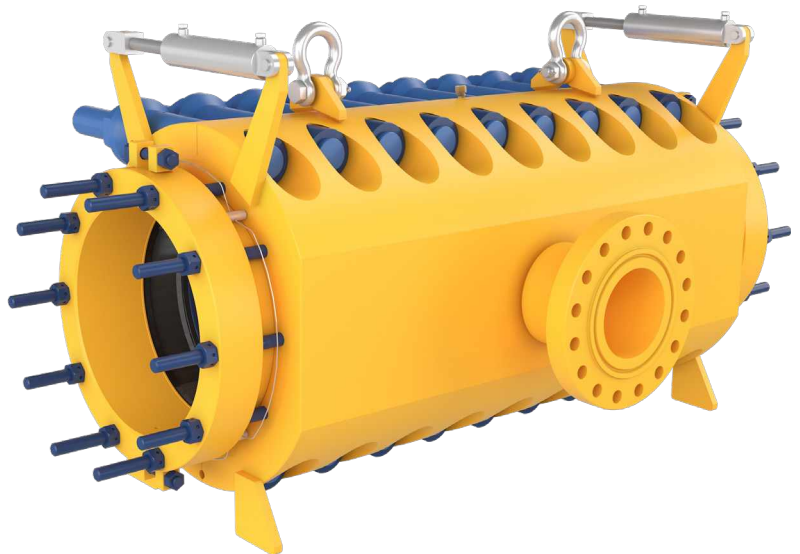
External coating: Carboline® 890 epoxy paint system, safety yellow color

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# Smart Tap

## Mechanical hot tap fitting

Our Smart Tap is a split, mechanical hot tap fitting that provides a flanged branch for hot tapping an existing subsea pipeline. The fitting effectively eliminates requirements for costly pipeline shut downs and expensive hyperbaric welding.



### FEATURES

**Fully mechanical and easy-to-install design**

**Lightweight and compact design**

**Offshore and onshore applications**

# Smart Tap

## Mechanical hot tap fitting

After tapping, the Smart Tap provides permanent, high-quality sealing integrity and structural reinforcement for the design life of the existing pipeline.

### Design Parameters

NPS: any API Specification 5L pipe and wall thickness

Service: Sweet (i.e. crude oil, natural gas, hydrocarbons, water, or chemical injection, etc.) and sour (i.e. hydrogen sulfide, carbon dioxide, etc.)

Design pressure rating: up to ANSI Class 2500

Design temperature range: 25°F to 250°F / -4°C to 121°C

Design life: 25+ years

Lateral NPS  $\leq$  Trunkline NPS

Hydraulic cylinder pressure (maximum): 3,000 psi (206 bar)

### Material Specifications

Body: ASTM A105 or A694 F60 forging for 12 in NPS and larger; ASTM A516 Gr. 70 pressure vessel plate for 10 in NPS and smaller

Actuator flanges: ASTM A105 or A694 F60 forging or ASTM A516 Gr. 70 pressure vessel plate

Weldolet and RTJ flange (lateral): ASTM A105 or ASTM A694 F52 or F60

Tension bowl and grips: AISI 4140 (i.e. ASTM A-519 Gr. 4140, Heat Treat to 34-40 Rc, NQ&T)

Compression rings and structural attachments: ASTM A36 or ASTM A516 Gr. 70

Seal extrusion guards (12 in NPS and larger): 316 stainless steel

Elastomeric circumferential and longitudinal seals: Viton™ B or Buna-N

Studs and nuts: ASTM A193 Gr. B7 and ASTM A194 Gr. 2H, respectively, all Xylan coated (i.e. PTFE, dark blue)

Anode(s): Galvalum® III

External coating: Carboline® 890 epoxy paint system, safety yellow color

### Applicable Design Codes, Standards, and Specifications (latest editions)

Smart Tap Drawings, Bill of Materials (Controlled Copies) and Vendor Supplied Material Test Reports

ISO 9001:2015 Quality Assurance - Quality Control Procedures & PCRS Operating Procedures

ASME Boiler Pressure Vessel Code, Section V Nondestructive Examination, Section VIII, Division 1 and 2 & Section IX Welding and Brazing Qualifications

ASME B16.5, Pipe Flanges and Flanged Fittings

ASME B31.4, Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids

ASME B31.8, Gas Transmission and Distribution Systems

ASME B18.2.1, Square and Hex Bolts and Screws Inch Series

API 6H, Specification on End Closures, Connectors and Swivels

API 5L, Specification for Line Pipe

MSS SP-44, Steel Pipeline Flanges

NACE MR0175, Sulfide Stress Cracking Resistant Metallic Materials for Oilfield Equipment

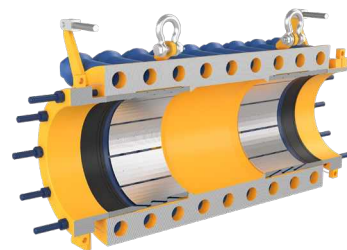
DNV Recommended Practice RP B401, Cathodic Protection Design

Code of Federal Regulations, Title 49, Parts 192 and 195

### Certifications

ISO 9001:2015 - World Certification Services Ltd. - Accredited by UKAS Quality Management

EN 10204 Section 3.1B (DIN 50049), Inspection Documents for the Delivery of Metallic Products

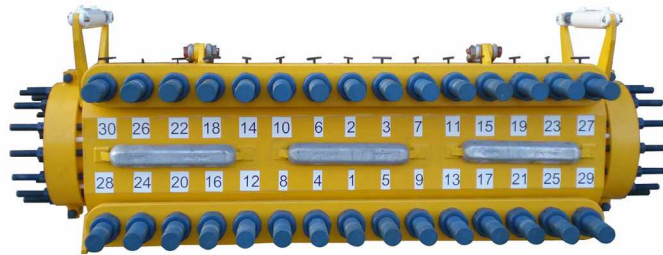


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# Diver Installed Smart Clamp

## Permanent pipeline repair solution

The diver installed Smart Clamp is a split mechanical fitting used to repair a damaged or leaking subsea pipeline. The fitting eliminates costly pipeline shut downs and expensive hyperbaric welding associated with alternative repair methods. After installation, the Smart Clamp design provides a permanent, high-quality seal and structural reinforcement for the duration of the design life of the pipeline.



### FEATURES

**Available in structural and non-structural configurations**

**Provides pressure containment within the encapsulated area**

**Cost saving, effective repair method**

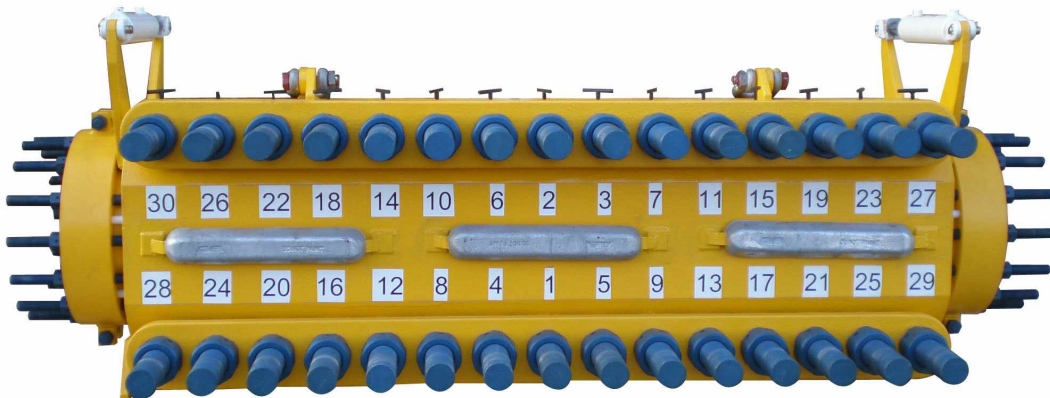
# Diver Installed Smart Clamp

## Permanent pipeline repair solution

Our structural and non-structural configurations ensure we meet diverse permanent pipeline repair requirements. Typically, the non-structural version is used to repair a pipeline that is structurally sound and has only minor damage such as pinhole leaks, local pipe wall thinning, or shallow dents. The structural clamp uses a grip and bowl mechanism to provide structural integrity to more severely damaged pipelines with defects including cracked girth welds, kinks, or punctures.

### Diver Installable Smart Clamp Design Features

- » Viton® B circumferential and longitudinal seals as standard, Buna-N (Nitrile) or other elastomeric compounds can be provided for compatibility with pipeline contents and inhibitors
- » Elastomeric circumferential seals are mechanically set, permanently pressurized, and fully restrained, mitigating concerns of explosive decompression effects for gas service
- » Seal extrusion guards for 12-in Nominal Pipe Size (NPS) and larger when API 5L pipe outside diameters tolerances become significant
- » Port for annulus testing, grout injection, or filling with inhibitor between the seals and pipeline
- » Galvalum® III anodes sufficient for 25-yr design life
- » Externally coated with 3-part marine epoxy
- » Hardened steel grips and bowls (structural version) provide reinforcement to the pipeline by transferring axial loads from the pipeline into the body of the fitting, effectively replacing structural integrity and removing longitudinal stresses from the damaged pipeline section
- » Internal components are securely retained whether the fitting is open or closed, before or after installation



## Technical data

### Design Parameters

Nominal Pipe Size (NPS): any API Specification 5L pipe and wall thickness

Service: Standard (i.e. crude oil, natural gas, hydrocarbons, water, or chemical injection, etc.) and Sour (i.e. hydrogen sulfide, carbon dioxide, etc.)

Design Pressure Rating: up to ANSI Class 2,500

Design Temperature Range: 25°F to 250°F / -4°C to 121°C

Design Life: 25 years

Length Between Circumferential Seals (Non-Structural version): design standard is the greater of 12 in or 1-nominal pipe diameter

Length Between Tension Grips (Structural version): design standard is nominal pipe outside diameter + 1.75 in

Internal Diameter at Center of Clamp: design standard is pipe outside diameter + 1.625 in

Hydraulic Cylinder Pressure (max): 2,500 psig (172 barg)

### Material Specifications

Body: ASTM A105 forging for 12 in NPS and larger; ASTM A516 Gr. 70 pressure vessel plate for 10 in NPS and smaller

Actuator Flanges: ASTM A105 forging or ASTM A516 Gr. 70 pressure vessel plate

Tension Bowl and Grips (Structural version): AISI 4140 (i.e. ASTM A-519 Gr. 4140, Heat Treated to 34-40 Rc, NQ&T)

Compression Rings and Structural Attachments: ASTM A36 or ASTM A516 Gr. 70

Seal Extrusion Guards (12 in NPS and larger): Type 316 stainless steel

Elastomeric Circumferential and Longitudinal Seals: Viton® B, 70/80 durometer

Studs and Nuts: ASTM A193 Gr. B7 and ASTM A194 Gr. 2H, respectively, all Xylan coated (i.e. PTFE, dark blue)

Anode(s): Galvalum® III

External Coating: Carboline® 890 Epoxy Paint System, safety yellow color

### Applicable Design Codes, Standards, and Specifications (latest editions)

PCRS Group Smart Clamp Drawings, Bill of Materials (Controlled Copies), and Vendor Supplied Material Test Reports

OIE ISO 9001:2015 Quality Assurance - Quality Control Procedures and PCRS Operating Procedures

ASME Boiler Pressure Vessel Code, Section V Nondestructive Examination

ASME Boiler Pressure Vessel Code, Section VIII, Division 1 and 2

ASME Boiler and Pressure Vessel Code, Section IX Welding and Brazing Qualifications

ASME B31.4, Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids

ASME B31.8, Gas Transmission and Distribution Systems

ASME B18.2.1, Square and Hex Bolts and Screws Inch Series

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API 5L, Specification for Line Pipe

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